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**PETROLEUM EXTRACTION AND ITS IMPACTS ON CLIMATE
CHANGE**

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Abstract

The extraction and usage of petroleum around the world has been exercised since the industrial revolution as a source of income and as a catalyst for economic development. However, this has drastically exacerbated climate change. Climate change is a transboundary issue that entails cataclysmic consequences such as severe droughts, flooding, the rise of sea levels, displacement of human settlements and the loss of habitats for flora and fauna. Mitigation and adaptation policies launched and exercised by governments across the world are imperative in avoiding or minimizing the impacts of climate change. This research aims to analyze the development, legal framework and climatic problems that arise from the extraction of oil and gas in Saudi Arabia, Kazakhstan, and Malaysia. This research also aims to provide feasible suggestions for governments and policy makers in nations that are still heavily reliant on the extraction and the usage of petroleum as the primary source of income in their respective countries in combating human-induced climate change.

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Keywords: Impacts, climate change, petroleum, oil & gas, extraction, GHG.



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1. Introduction

According to the United Nations Framework Convention on Climate Change (UNFCCC), climate change is defined as 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods' (United Nations General Assembly, 1994). Thus, following the definition provided by the UNFCCC, it is safe to construe that climate change is not inherently human-made nor natural but in genesis, a combination of both. Climate change is not a novel phenomenon. It was found that in a span of approximately 300 years, known as the Medieval Warm Period (MWP) circa A.D 950 to 1250, the earth's surface was substantially warmer than what climatologists consider normal. However, with the trigger of the industrial revolution in the 19th century, men have since come to have a big hand in climate change (Keller, 2014). For the past 250 years, the global average temperature has risen nearly 1°C (Sagar, Oliver, & Chikkatur, 2005). Within this time span of 250 years, the most rapid increase was reported during the past 30-40 years. The recent Special Report published by the Intergovernmental Panel on Climate Change (IPCC) in October 2018 concurs with this fact. The report notes that human activities have caused approximately 1.0°C of global warming and such increase in temperature is projected to spike an additional .5°C between 2030 and 2052 if it continues to increase at the current rate (Slezak, 2012). When it comes to the question of human activity, the word petroleum or the phrase oil and gas is not to be discounted from the equation in exacerbating our climatic problems, given that carbon dioxide emissions from fossil fuel such as petroleum combustion contribute significantly to the world's increasingly pressing climate circumstance. The special report published by IPCC (2018) also warned that if the increase of global average temperature is to reach the benchmark of 1.5, tropical countries such as Malaysia and Vietnam along with countries such as Japan, China, Egypt, and US (World Meteorological Organisation, 2007) will experience increased flooding by 2040. Thus, it is high time for nations that is heavily depended on the extraction and usage of fossil fuels to start looking into and sourcing for the implementation of alternate energy sources in view of the depletion of crude oil and to avoid the cataclysmic climatic implications that are bound to happen if mitigation and adaptation measures are not put in place with immediate effect

2. Problem Statement

The current implementation of climate change mitigation policies in petroleum extraction may not be feasible in reducing GHG emissions. According to a Special Report in 2018 by the IPCC, by 2100, the global mean sea level rise is projected to be around 0.1 meters lower with global warming of 1.5°C compared to 2°C. Sea levels will continue to rise well beyond 2100, and the magnitude and rate of this rise depend on future emission pathways. This qualitative case study will explore the status of statutes, legislation, codes, and regulations in selected countries and weigh if the implementation is bringing about any improvements within the countries. The data and comparisons done in this study may also provide Malaysia with a broader range of climate-friendly alternatives to the petroleum extraction industry

3. Research Questions

- 3.1** What are the effects upon climate change brought about by the oil and gas industry?
- 3.2** Are government policies by way of legislation sufficient in reducing the effects of climate change brought about by petroleum extraction?

4. Purpose of the Study

The purpose of this paper is first; to analyse the historical development of petroleum extraction activities carried out by Saudi Arabia, Kazakhstan and also Malaysia to provide readers a historical foundation on how the petroleum extraction policies in the respective countries. It is also the intention of the authors to analyse the existing legal positions and developments constructed and initiated by governments in these countries in terms of combating climatic problems arising from petroleum extraction, and other climate change mitigating initiatives such as the implementation of sustainable development regionally. The authors will also provide suggestions, based on the studies, for these countries and countries that are still dependent on the extraction and the usage of petroleum in mitigating climatic problems arising from the extraction and the usage of petroleum.

5. Research Methods

The research method chosen for this paper is the documentary analysis method. The authors obtained information on the research subject only from pre-existing documents without adopting other standard practices such as direct questioning through interviews, questionnaires or observations. The methods used in this paper precisely are:

5.1. Library Research

Library research was adopted to collect facts, figures and statistical reports in relation to the research focus, which highlights petroleum extraction, the rates of such extraction and the repercussions of such extraction on climate change.

5.2. Legal Impact Analysis

The authors also used the legal impact analysis approach to record how policies, laws and legal frameworks work within the petroleum extraction industry that involve climate change.

6. Findings

6.1. Saudi Arabia

6.1.1. Historical Development of Saudi Arabia's Petroleum Industry

On March 3, 1938, an American-owned oil well in Dhahran, Saudi Arabia was drilled and is now identified as the largest source of petroleum in the world. Oil accounts for more than 92% of the Saudi budget (National Geographic, 2014)

The oil and gas sector are, by a significant margin, the most important contributor to the Kingdom of Saudi Arabia's economy, which traditionally runs a significant annual current account surplus, as well as a major source of the country's global financial and political influence. The Kingdom has some 265 billion barrels of proven and recoverable oil, accounting for up to a quarter of global oil reserves, and up to 258 trillion cubic feet of natural gas, the fourth-largest reserves in the world.

6.1.2. Legal Framework of Saudi Arabia's Petroleum Industry

Since 1963 until 2004 extending to now, there has been a holistic approach towards environmental protection in Saudi Aramco. In 1963, the issue of the First Corporate Environmental Policy Statement was released by the Arabian American Oil Company to prevent pollution and other detrimental effects to the coastal waters of Saudi Arabia as a result of its operations.

The only multi-national organization in the Gulf is Regional Organization for the Protection of Marine Environment (ROPME). The objective of this organization is to coordinate the efforts of the Member States' (Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates) to address many issues, but most importantly as related to this case study is to abate the pollution caused by the development activities of the member States.

Besides this, there are also an existing and comprehensive set of laws governing the field such as the Decree for the establishment of the Environmental protection Committee in Bahrain, the law protecting the Environment in Kuwait (1980), Iraq's Environment Protection and Improvement Act (1986), Act for Environment Protection and Pollution Control in Oman (amended 1985), Saudi Arabia's Environmental Protection Standards (PME) and, the Decree Concerning The Establishment of The Supreme Committee For Environment And Its Mandate In The United Arab Emirates.

6.1.3. Climatic Problems Arising from Petroleum Extraction in Saudi Arabia

The Arabian Gulf is the world's primary source for many things, but from the environmental point of view, primarily fresh water, seafood, and oil. The gulf is rich with many habitats that are actively inhabited by a wide range of flora and fauna, such as mangroves, seagrasses, coral reefs, and salt marshes. (Qurban, Joydas, Mani, Krishnakumar, & Wafar, 2011). The problem with protecting and maintaining the existence of these unique natural habitats arises because Arab Saudi is located within the richest oil reserves in the world which contains 21.9% of the world's oil reserves. To meet the rising energy demand around the globe, the conventional solution for this challenge is to increase production. One issue associated with the increased production is the extremely damaging effects on the environment due to the exploration, production, and distribution of oil.

The exploration and production of petroleum on its own lead to detrimental effects of the ecosystem. The sources of contaminants include formation water that has an oil content of 30 to 40 ppm, drilling fluid chemicals, oil and water based drilling muds and cutting, oil spilled during the extraction process, fuel oil from ships and equipment used in the production of oil and gas for commercial purposes and the flaring of associated natural gas, including methane and other light hydrocarbons (Qurban et al., 2011). Besides the process itself, coastal and offshore installations and constructions, laying of submarine pipelines, submarine

cables, dredging, trenching and landfilling also creates contaminants. The same goes for oil spills (Qurban et al., 2011).

One instance where the extraction in The Gulf affects climate change is seen in the field of exploration and production. Drill wastes alter the sediment granulometry and cause burial and mortality of seabed animals. Contaminants like Barium and Petroleum Hydrocarbon (Ba and TPH) are toxic to marine life and the increased concentration of these properties in the tissue of marine organisms can cause harm to sea animals (Qurban et al., 2011).

Apart from this, the IPCC released a report warning that the world is warming quicker than expected. One consequence of this is the human beings might have to cope with an increasing amount of venomous bites, stings, and other brush ups with poison due to climate change as poisonous species may turn out to be normal in new ranges. Species affected because of hotter water include lionfish, ocean snakes, crown-of-thorns starfish and various distinctive sorts of venomous jellyfish (Learn, 2018). Meaning to say, a physical increase of harmful contaminants is only aiding this process and not in any way slowing down the detrimental effects of already actively happening climate-change.

Coastal and offshore constructions in Saudi Arabia in the field of petroleum extraction also involves the process of flaring primarily consists of the burning of fossil fuels which produces black carbon. Data shows that at present, Saudi Arabia ranks 14th emitting 118 million metric tons of carbon. A striking element of the time arrangement for Saudi Arabia is the outflows coming about because of flaring gas in the oil fields. In 1974, gas flaring represented 76% of Saudi Arabia's petroleum derivative discharges. As new advancements were consolidated into the oil fields and it wound up conceivable to refine or reinject these gases, CO₂ outflows from gas flaring fell strongly and more as of late record for under 1% of aggregate discharges. Per capita emanations have grown ten times since 1950; at 4.69 metric huge amounts of carbon per individual, they are well over the worldwide average. (Carbon Dioxide Information Analysis Center, 2012)

6.2. Kazakhstan

6.2.1. Historical Development of Kazakhstan's Petroleum Industry

Kazakhstan is a country covering approximately 2.7 million square kilometres. With a population of 18.3 million people, it is abundantly rich in natural resources such as petroleum. The historical development of oil and gas extraction in Kazakhstan began as early as 1899 with the development of the Ural-Emby pool oil field. Gradual development from geological researching subsequently led to the discovery of a set of oilfields in the regions of Atyrau, Aktobe, and Mangistau. Studies show that Kazakhstan's oil resources are estimated at several billion tons. In 1993, Kazakhstan produced about 545,000 bpd (barrels per day) and by 2004, production levels reached 1.18 million bpd. Between 1999 and 2004, oil production grew at an annual rate of 15 percent annum (Ministry of National Economy of the Republic of Kazakhstan, 2018). In crux, Kazakhstan's oil sector currently accounts for approximately 30 percent of gross domestic product and 57 percent total annual export revenues.

6.2.2. Legal Framework of Kazakhstan's Petroleum Industry

The central government agency that regulates the development of oil and gas extraction is the Ministry of Oil and Gas. The ministry's principal obligation is to prepare tenders for the grant of rights to develop oil reserves, approves work programmes and assignment of rights over the subsurface (Kaiser & Pulsipher, 2007). Presently, The Subsurface Law is the primary legislation in regulating oil and gas activities. The primary purpose of the legislation is to grant rights for the usage of subsurface and set out the rights and obligations of subsurface users. Before 1999, Kazakhstan's policies surrounding petroleum extraction did not adequately address environmental or potential climatic impacts resulting from petroleum extraction as the country's primary concern at that time was attracting more foreign investors (Mitrofanskaya, 2000). In 1999 Kazakhstan's President Nursultan Nazarbayev shed light on the need for environmentally friendly technologies in petroleum extraction (Mitrofanskaya & Bideldinov, 1999). Subsequent to that, the newest legislation that ties petroleum extraction with the environment is The Ecological Code of the Republic of Kazakhstan (Environmental Code of the Republic of Kazakhstan, 2007). The code's focus is to establish the government's authority in regulating various aspects of the natural environment and set institutional relations with government departments (Derman, 1993). Article 94-10 of the code also stated *inter alia*, the use of renewable energy by legal entities on internal projects in Kazakhstan (Mills, 2014). The code also includes provisions related to climate change mitigation and adaptation methods and allows the operation of a national carbon trading scheme. Although Kazakhstan is performing moderately well on human development at the national level, there are solid inconsistencies at the regional level considering that just two of the fourteen districts of Kazakhstan are categorized as 'Tier 1' in spearheading sustainable development (Partners, 2016).

6.2.3. Climatic Problems Arising from Petroleum Extraction in Kazakhstan

Kazakhstan has a continental climate with hot summers, harsh winters (strong snow showers and strong winds) and limited precipitation. A 2–3°C increase in surface temperature will decrease the vegetation cover, which is estimated to increase the occurrence of mudflow tenfold in combination with increasing heavy precipitation events and glacial melting. Mudflows are already threatening 156 towns and cities, including Almaty (the largest city in Kazakhstan). Kazakhstan's energy supply is vulnerable to the impact of extreme weather on its energy infrastructure due to an extensive electric and fossil fuel network as hydropower accounts for only 13 percent of Kazakhstan's electricity production (USAID, 2017). For example, flooding and mudflow in Almaty in 2015 caused considerable damage to power lines. Climate stress is added to the pressures of rising demand, low-efficiency transmission and distribution networks, and aging facilities.

6.3. Malaysia

6.3.1. Historical Development of Malaysia's Petroleum Industry

The first oil well in Malaysia was sunk in 1910 by Shell on Canada Hill in Miri, Sarawak and by December 1910, it produced 83 bpd. In the late 1960s, foreign oil companies turned to the Malaysian Offshore Peninsula, and then Esso and Conoco received oil and gas concessions off the eastern coast of the

Peninsula (Malaysian Development Bank, 2011). At the time of the establishment of PETRONAS¹, four of the nineteen oil fields in Malaysia were producing between 90,000 and 99,000 bpd. With Malaysia's growing economic nationalism culminating in the New Economic Policy (NEP)², PETRONAS was incorporated as a public limited company. PETRONAS received its power from the 1974 Petroleum Development Act, a piece of legislation that granted PETRONAS ownership and exclusive rights and powers over Malaysian hydrocarbon resources.

6.3.2. Legal Framework of Malaysia's Petroleum Industry

The main piece of legislation that regulates oil and gas extraction in Malaysia is the Petroleum Development Act 1974 (PDA) that was enacted in light of the 1973 global oil crisis. Subsequently, the government incorporated PETRONAS as a public limited company and in pursuant of the PDA, all ownership and its exclusive rights, liberties, powers, privileges to explore, win and obtain onshore and offshore petroleum in Malaysia is vested in PETRONAS. Thus, a company is required to enter into a production sharing contract (PSC) with PETRONAS in order to obtain the right to explore, develop and manufacture oil. Another vital piece of legislation is the Petroleum Regulation 1974 (Petroleum Regulation) that govern oil and gas exploration and production activities both onshore and offshore in Malaysia (Aziz, 2016, p. 166). Both legislations set out the licensing requirements for up and downstream activities in refining, marketing and distributing oil products. The transportation, storage, and handling of oil and oil products are under the purview of the Petroleum (Safety Measures) Act 1984.

Regarding its environmental protection policies, the Environmental Quality Act 1974 (EQA), is the central act that governs the protection of the environment and the prevention of oil spills and pollution on land and waters. However, the EQA does not extend its emphasis to sustainable development and renewable energy in tackling climate change. It was only in 2009 that the cabinet passed the National Policy on Climate Change (NPCC) (Ministry of Natural Resources and Environment Malaysia, 2010) that mainstreams the mitigation and adaptation of climate change in Malaysia in a cross-sectoral manner. The primary purpose of the NPCC is to spearhead climate resilient development in which it serves as a tool for harmonizing and integrating climate change adaptation and mitigation measures and disaster risk reduction measures.

6.3.3. Climatic Problems Arising from Petroleum Extraction in Malaysia

Despite the lack of statistical data on the climatic impacts arise from oil-drilling activities in Malaysia, research (Al-Amin, 2011) has shown that the increase of surface temperature in Malaysia will subsequently lead to a large proportion of the Malaysian population susceptible to the effects of extreme weather events such as droughts and floods that are associated with climate change. Without sufficient measures, change in the regional climate will cause floods and an increase in sea level could that could cause displacement of people and damaged infrastructures (Daud, Mohamed, & Abas, 2015). Besides, agricultural produce from eroded or inundated lands will be halted due to extensive flooding. Recent

¹ Established in 1974, Petroliaam Nasional Berhad (PETRONAS) is Malaysia's fully integrated oil and gas multinational corporation that is vested with the entire oil and gas resources in Malaysia.

² Malaysia's New Economic Policy (NEP) was announced in 1970 as part of a myriad of economic measures introduced after the political crisis in May 1969. Its objective is to 'eradicate poverty' and 'restructure society to eliminate the identification of race with economic function' in order to foster national unity.

research has also shown that Malaysia is already facing the implications of agricultural production arising from climate change (Masud et al., 2014; cited in Flowers, 2017) such as Kelantan and Terengganu which are facing heavy climatic changes such as frequent rainfalls that has compromised agricultural productivity in those areas. Rice yields and oil palm plantation productivity will also be affected in Malaysia for every 1°C of temperature rise. With 29,000 square km of land in Peninsular Malaysia that is flood prone, such geographical vulnerability is directly placing 4.82 million people at risk of displacement, infrastructural and physical danger.

6.4. Recommendations to mitigate carbon emissions

6.4.1. Government Mitigation of Carbon Emission through 80:20 Rule (Pareto Principle)

The cost related expense and any decrease in Net Present Value (NPV) should be weighed against both the ecological expense and potential reputational harm from an absence of alleviation. Some Liquefied Natural Gas (LNG) makers are as of now sequestering carbon dioxide instead of venting, and comparable imaginative arrangements are required over the industries that emit carbon. Here the governments of countries that are actively involved in natural gas fields through legal frameworks should implement the 80:20 weightage principle in LNG handling, flaring, venting and fugitives.

6.4.2. Governments take up 0 Carbon Production Manifestos

The key to every successful mitigation first begins with the actions of the largest power in the country, which is more often than not, the government. If a government plants seeds in reusable energy sources such as wind and solar power, that will amount to more sustainability for the environment. One example is to implement the policy by the Malaysian government to offer tax exemptions for fully imported hybrid and electric cars.

6.4.3. Portfolio High Grading

The decrease of carbon emissions by this sector can be accomplished by portfolio administration and judicious organic investment. This is the art and science of making decisions about policy, matching investments to objectives, asset allocation and balancing risk against performance. For example, in Canada, International Oil Companies (IOCs) sold nearly US\$20 bn of oil sands resources in Canada in 2018 and cutting carbon presentation was a factor in a few of the above exchanges as according to Forbes (as cited in Flowers, 2017) Regardless of that, every one of those deals still had a purchaser which technically means the industry faced no loss from the improvement made. By this step also, fields that are carbon intensive such as the oil and gas industry will only be handled by specialists.

7. Conclusion

The oil and gas industry has been contributing increasingly to the damage of the environment, primarily through intensive carbon emissions. At this rate, decarbonization should be the sole intent of the industry and entities in power like the governments of countries that actively participate in the oil and gas

industry. The industry's emission rate is only set to spike by 20% within the mid-2020s. Data also shows that LNG, oil sands and heavy oil are most heavily carbon packed and are among the five main contributors, that include tight oil and shale gas.

The impacts of oil and gas along with industrialization and globalization, primarily to meet global oil demand is inevitable. However, measures need to be taken to reduce the carbon emission produced by the industry. As according to the recommendations as stated above, this can be done primarily by the government and the individuals governing a company involved in oil and gas. These parties hold most autonomy and can make change if they want.

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